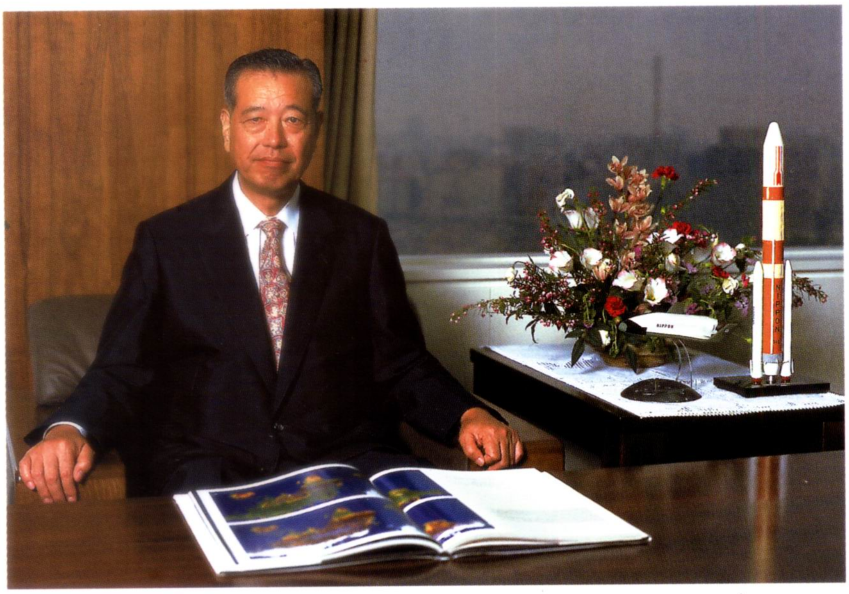
NASDA

NATIONAL SPACE DEVELOPMENT AGENCY OF JAPAN



ISAO UCHIDA

Introduction by President

Over the last 50 years, mankind has been conducting space development activities in order to unravel the mysteries of the universe and to assess the possibility of using space. The results have been used to improve technologies and to enrich our lives. In addition, invaluable knowledge has been gained from satellite-observation data. Today, satellites are being used in many ways to improve our everyday life and manned flights have been undertaken on a regular basis, yet the potential of the cosmos in which we travel remains largely unknown.

The universe holds the secret to new technologies, materials and medical advances. These can be developed by utilizing the space environment and the untapped natural resources of the moon and planets. Large-scale production in space will ultimately become a reality, and the global cooperation seen in the International Space Station project marks a major step toward achieving that goal.

In the 21st century, mankind will continue to unveil the mysteries of the universe and study extending the scope of human activities in outer space. Furthermore, observation data acquired by satellites in space will help solve environmental problems on Earth.

Since its establishment over 30 years ago, NASDA has developed sophisticated technologies that have won international acclaim. NASDA is fully committed to maintaining its momentum in space development in the future, and will work with other countries and organizations to help preserve the Earth and secure a better future for humanity. Your support and encouragement would be highly appreciated.

Executive Members

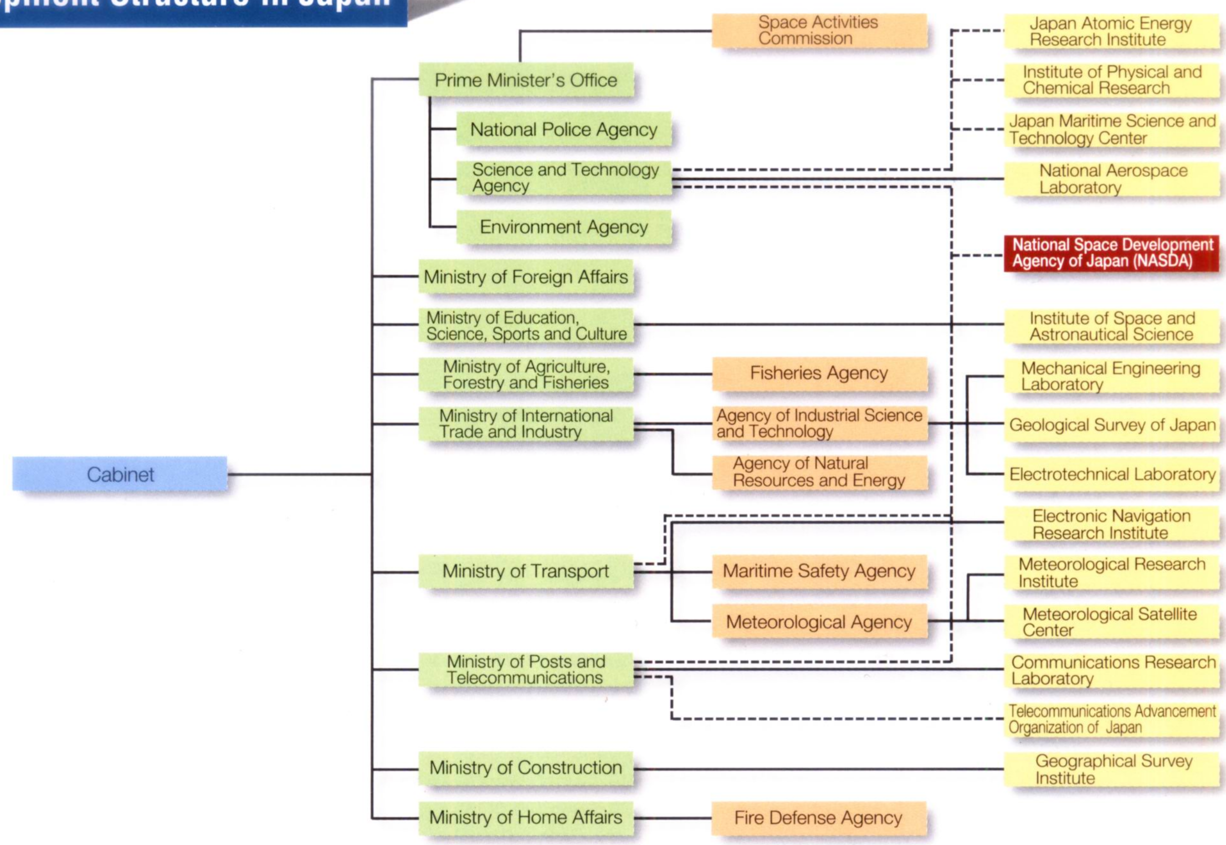
Vice President	Tomifumi Godai
Executive Director	Toshihiro Ishii
Executive Director	Masatoshi Saito
Executive Director	Shuuichi Miura
Executive Director	Eiji Sogame
Executive Director	Yoji Furuhama
Executive Director	Haruto Hirosawa
Executive Director	Jyunichi Nose
General Auditor	Takuji Yamagami
General Auditor	Toshio Kato

(as of January,2000)

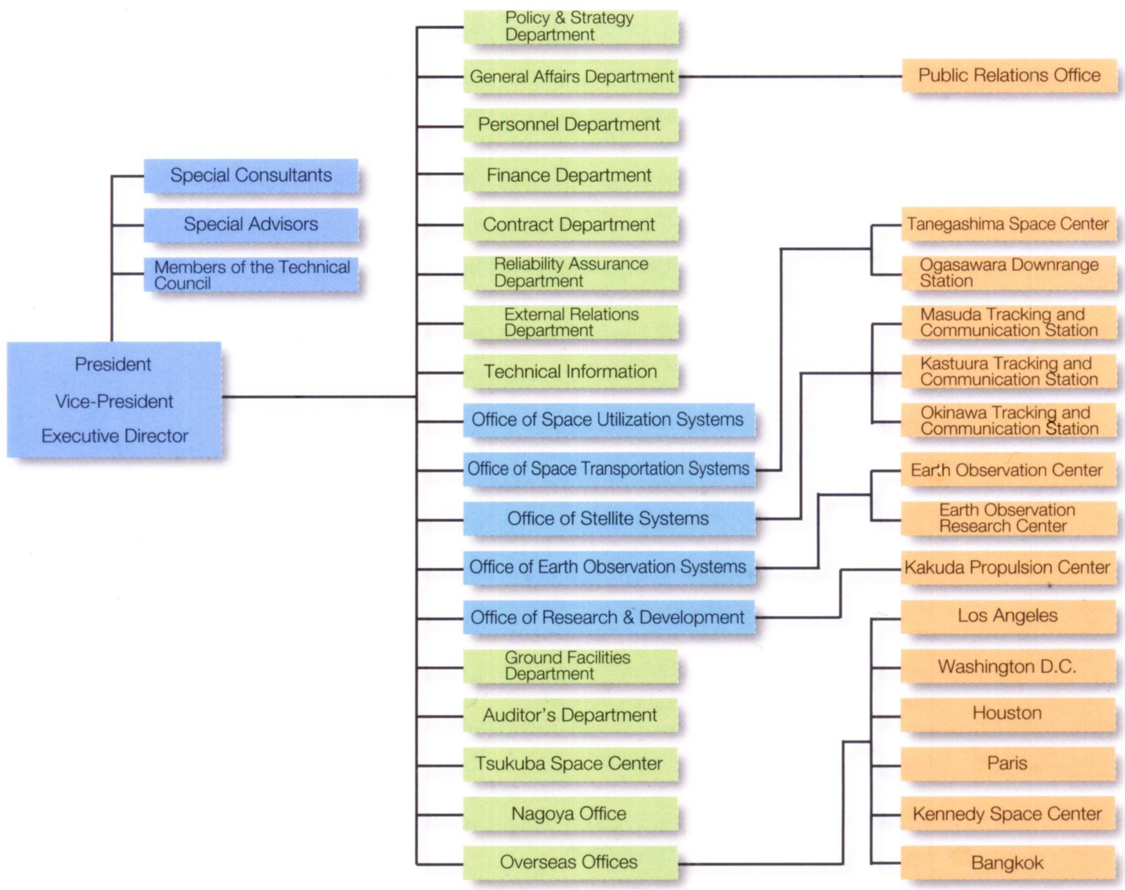
History of NASDA

June 1969	The National Space Development Agency Law was approved by the 61st session of the National Diet.
Oct. 1969	NASDA was established and operations started at Headquarters, Tanegashima Space Center, Kodaira and Mitaka Branches, and Katsuura and Okinawa Tracking and Communication Stations.
Oct. 1970	Start of N-I launch vehicle development.
May 1972	Opening of Nagoya Office.
June 1972	Establishment of Tsukuba Space Center.
May 1974	Establishment of Ogasawara and Masuda tracking stations.
Sept. 1975	Start of launching of N-I launch vehicle.
1976	Start of N-II launch vehicle development.
Oct. 1978	Establishment of Earth Observation Center.
Aug. 1979	Opening of space museum at Tanegashima Space Center.
July 1980	Establishment of Kakuda Propulsion Center.
Feb. 1981	Start of launching of N-II launch vehicle. Start of H-I launch vehicle development.
Sept. 1982	Completion of launching of N-I launch vehicle (seven satellites launched). Start of facility construction for launching H-I launch vehicle at Tanegashima Space Center.
Aug. 1985	Selection of three Japanese payload specialists for U.S. space shuttle. Start of International Space Station preliminary design. Start of facility construction for launching H-II launch vehicle at Tanegashima Space Center.
Aug. 1986	Start of launching of H-I launch vehicle. Start of H-II launch vehicle development.
Feb. 1987	Completion of launching of N-II launch vehicle (eight satellites launched).
Sept. 1988	Signing of Intergovernmental Agreement (IGA), framework for the design, development, operation and utilization of the International Space Station, by the U.S., Japan, European countries and Canada. Completion of the firing test facility for the LE-7 engine at Tanegashima Space Center.
June 1989	Approval of IGA by the National Diet of Japan.
Apr. 1990	Selection of the prime payload specialist for the first Material Processing Test, Fuwatto '91, aboard U.S. space shuttle.
July 1991	Start of selection process for Japanese astronauts.
Feb. 1992	Completion of launching of H-I launch vehicle (nine satellites launched).
Apr. 1992	Selection of one astronaut candidate.
Sept. 1992	First Material Processing Test, Fuwatto '92, aboard the U.S. space shuttle.
Oct. 1992	Selection of Japanese payload specialist for Second International Microgravity Laboratory Mission (IML-2).
Apr. 1993	Start of J-I launch vehicle development.
Feb. 1994	Start of launching of H-II launch vehicle. Launch of Orbital Re-entry Experiment (OREX), Ryusei, and Vehicle Evaluation Payload (VEP), Myojo, by H-II-1F launch vehicle.
July 1994	Implementation of IML-2.
Aug. 1994	Launch of Engineering Test Satellite-VI (ETS-VI), Kiku-6, by H-II-2F launch vehicle. (Injection into orbit failed due to malfunction in the apogee engine.)
Mar. 1995	Launch of Space Flyer Unit (SFU) and Geostationary Meteorological Satellite-5 (GMS-5), Himawari-5, by H-II-3F launch vehicle.
Jan. 1996	SFU retrieved by the space shuttle Endeavor (STS-72).
Feb. 1996	Start of launching of J-I launch vehicle. Launch of Hypersonic Flight Experiment (HYFLEX) by J-1-1F launch vehicle. (Retrieval abandoned due to cut-off of the riser.)
May 1996	Selection of one astronaut candidate.
July-Aug. 1996	Automatic Landing Flight Experiment (ALFLEX) conducted 13 times.
Aug. 1996	Launch of Advanced Earth Observing Satellite (ADEOS), Midori, and the Japan Amateur Satellite (JAS-2), Fuiji-3, by H-II-4F launch vehicle.
Nov. 1997	Japan's first extravehicular activity on STS-87 mission. Launch of Engineering Test Satellite-VII (ETS-VII), Kiku-7, and Tropical Rainfall Measuring Mission (TRMM) by H-II-6F launch vehicle.
Feb. 1998	Launch of Communications and Broadcasting Engineering Test Satellite (COMETS), Kakehashi, by H-II-5F launch vehicle. (Injection into orbit failed due to malfunction in the second-stage engine.)
Oct. 1998	Life science experiments conducted on STS-95 mission.
Feb. 1999	Selection of three astronaut candidates.

Space Development Structure in Japan

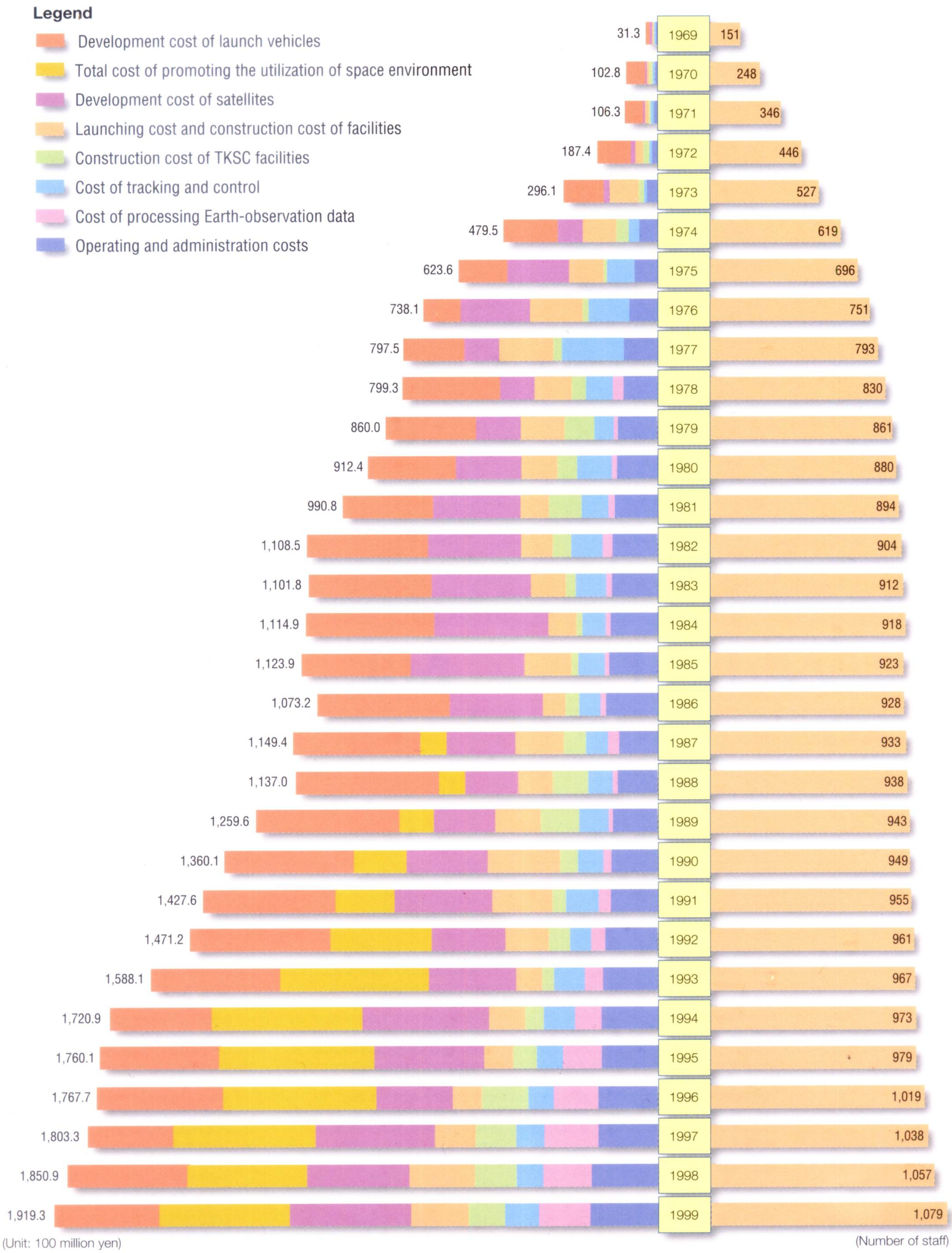


NASDA Organization

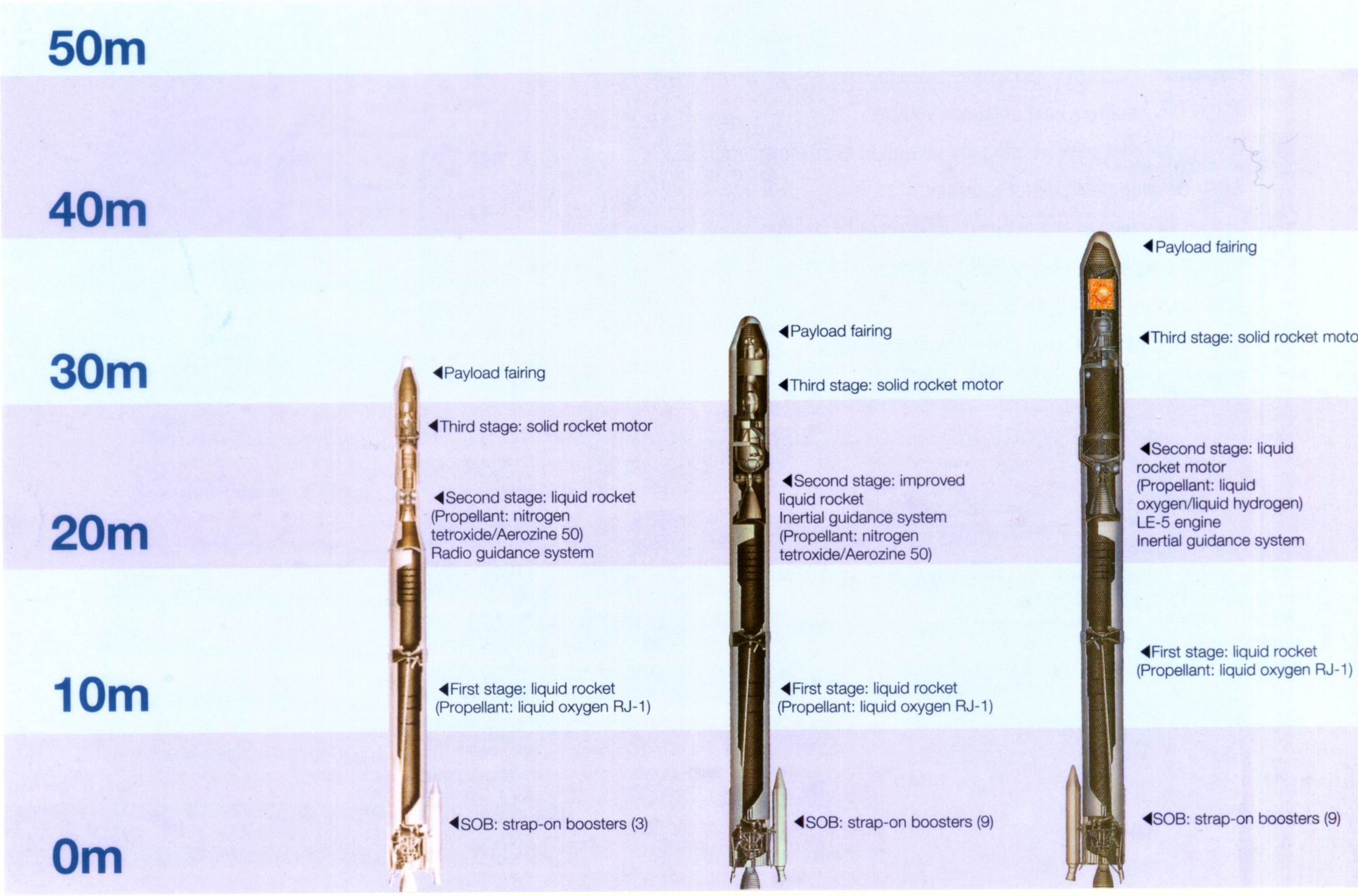


Budget Trends

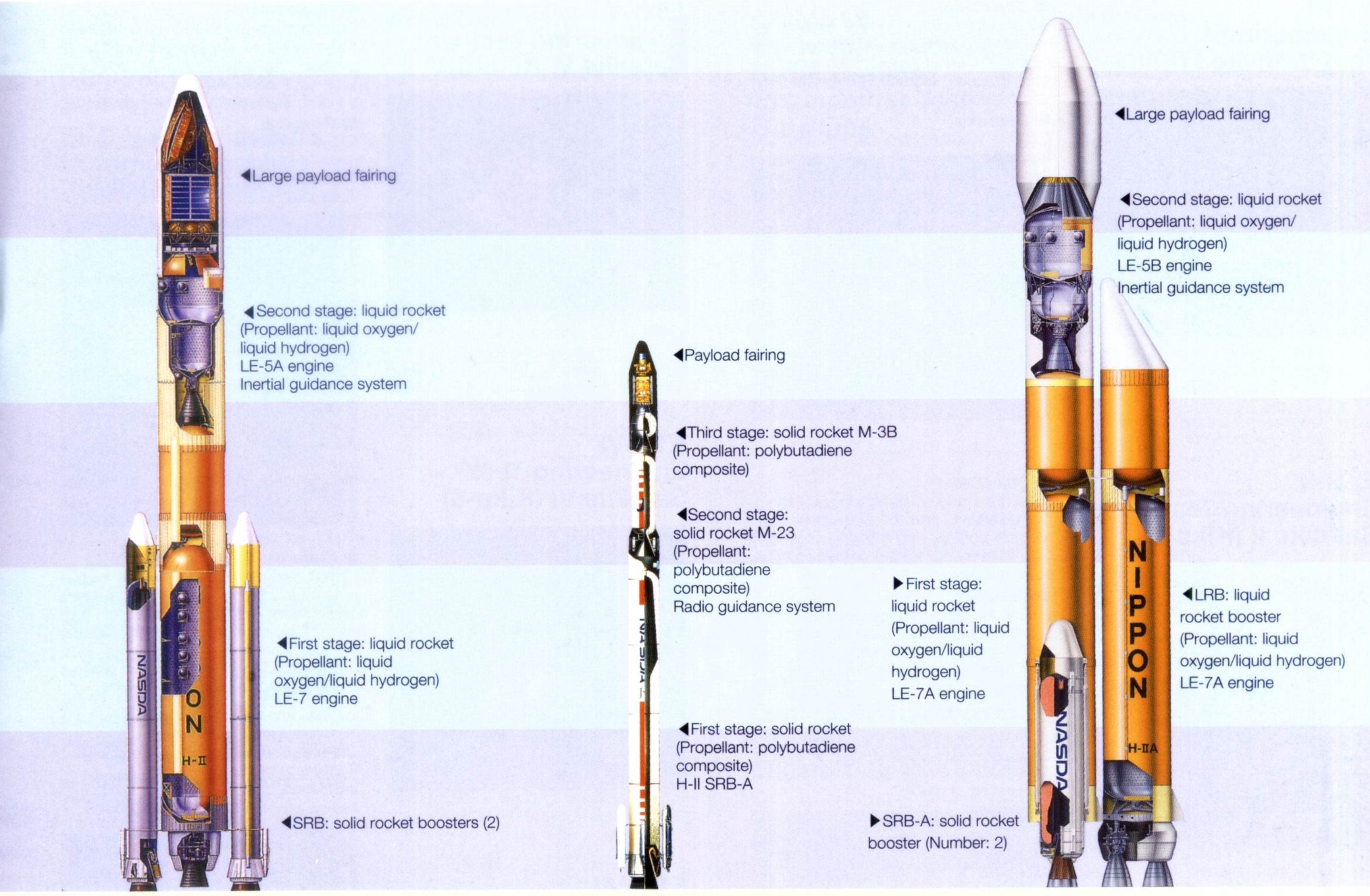
Personnel Trends



Launch Vehicles



Name	N-I	N-II	H-I
Total weight (tons; excluding payload)	Approx. 90	135	140
Overall length (m)	Approx. 33	35	40
Diameter of first stage (m)	Approx. 2.4	2.4	2.4
Capability to launch geostationary satellites (kg) (including weight of apogee motor case)	Approx.130	350	550
Major features:	N-I is a three-stage launch vehicle (liquid/liquid/solid) employing the U.S. Thor-Delta rockets' technology. It played an important role in the early stages of Japan's space development activities, including the launch of Japan's first geostationary satellite, ETS-II or Kiku-2, and the accumulation of rocket technology and satellite orbit injection technology. The N-I launch vehicle was used to launch seven satellites from 1975 to 1982.	Like the N-I launch vehicle, N-II is a three-stage launch vehicle (liquid/liquid/solid) employing the U.S. Thor-Delta rockets' technology. The geostationary satellite launch capability was increased to 350 kg, and the launching precision was improved by introducing the inertial guidance system. The N-II launch vehicle was utilized in eight launches from 1980 to 1986, and contributed to the era of full-scale utilization of application satellites.	The H-I is a three-stage launch vehicle (liquid/liquid/solid) that can launch a 550 kg satellite into geostationary orbit. It was developed to meet the needs of large satellites, such as for communications, broadcasting and meteorological observation. The H-I's second stage adopts a domestically developed liquid oxygen/liquid hydrogen engine known as the LE-5, which then represented one of the world's leading technological advances. The H-I launch vehicle was used to launch nine satellites from 1986 to 1991, including the Geostationary Meteorological Satellite, GMS-4 or Himawari-4, and the Japanese Earth Resources Satellite 1, JERS-1 or Fuyo-1.
Launched satellites (including planned launches)	ETS-I／ISS／ETS-II／ISS-b／ECS／ECS-b／ETS-III	ETS-IV／GMS-2／CS-2a／CS-2b／BS-2a／GMS-3／BS-2b／MOS-1	EGS／ETS-V／CS-3a／CS-3b／GMS-4／MOS-1b／BS-3a／BS-3b／JERS-1



H-II	J-I	H-IIA (Augmented vehicle) (Standard)	(Augmented)
260	92	288	405
50	26	53	53
4	2.5	4	4 (Core) 4 (LRB)
2,000	Low-Earth orbit 870 (250 km)	2,000	Approx. 3,750

With the capability to launch a two-ton-class satellite into geostationary orbit, the H-II is a two-stage launch vehicle (liquid/liquid) with large solid rocket boosters. It was developed with Japanese technology in all stages. The first stage has the LE-7 engine that was newly developed for the H-II, and the second stage uses the LE-5A engine, an advanced model of the LE-5 engine. For greater economy, the H-II can simultaneously launch two geostationary satellites weighing about one ton each. The H-II has played a key role as the main launch vehicle in Japan's space program since 1993.

The J-I launch vehicle is a three-stage solid fuel launch vehicle developed to meet the expected demand for launching smaller satellites. The first-stage motor is identical to the solid rocket booster (SRB) of the H-II launch vehicle. The second and third stages use the upper stage of the M-3SII launch vehicle developed by the Institute of Space and Astronautical Science. The combination of existing launch vehicles enabled rapid development at low cost and a reduction of launch site operations. The J-I launch vehicle offers high mobility.

The H-IIA launch vehicle is designed to meet future diverse needs in space development, such as for four-ton-class large satellites, the unmanned HOPE-X, and lunar and planetary exploration. Based on the H-II launch vehicle technology, H-IIA can flexibly meet launch demands by changing the kind and number of additional rocket boosters (hydrogen boosters, kerosene boosters, etc.).

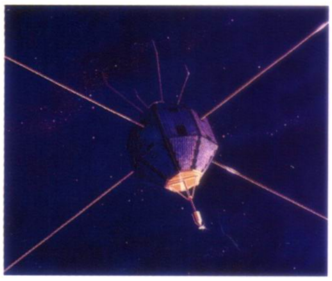
OREX／VEP／ETS-VI／GMS-5／SFU／ADEOS／COMETS／ETS-VII／TRMM／MTSAT／MDS-1/DRTS-W

HYFLEX／OICETS

ARTEMIS／ADEOS-II／DRTS-E／USERS／HTV／ALOS／ETS-VIII／SELENE／HOPE-X

Engineering Test Satellites

ETS-I Engineering Test Satellite I (Kiku)

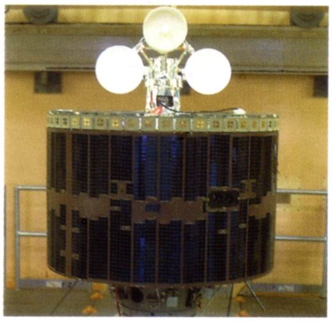


● **Objectives:**
To acquire comprehensive technology information, such as on the performance of the N-I launch vehicle, the satellite's orbit injection, attitude control, tracking and control.

● **Features:**
ETS-I is NASDA's first satellite and also the first mission for the N-I launch vehicle. It has 26 faces with a diameter of 80 cm, and is equipped with deployable antenna experimental equipment.

Launch: September 9, 1975/N-I launch vehicle 1F/Tanegashima Space Center
Orbit: circular orbit at an altitude of approx. 1,000 km
Inclination: approx. 47 degrees
Period: approx. 1C6 minutes
Weight: approx. 82.5 kg

ETS-II Engineering Test Satellite II (Kiku-2)

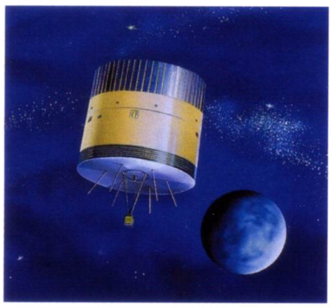


● **Objectives:**
To acquire data on launching geostationary satellites, on-orbit stationkeeping, attitude control, and tracking and control. To carry out testing on communications in space.

● **Features:**
ETS-II is Japan's first geostationary satellite. It carried out tests on communication equipment in outer space, and was fitted with a mechanical despun antenna.

Launch: February 23, 1977/N-I launch vehicle 3F/Tanegashima Space Center
Orbit: geostationary orbit at an altitude of approx. 36,000 km and 130 degrees East longitude
Weight: approx. 130 kg

ETS-IV Engineering Test Satellite IV (Kiku-3)



● **Objectives:**
To acquire technologies to manufacture large satellites, to perform testing of onboard equipment and to confirm the launching capability of the N-II launch vehicle.

● **Features:**
ETS-IV carries a horizon sensor with turning head, and has a pulse-type plasma engine. It is cylindrical with solar cell panels attached all around the surface.

Launch: February 11, 1981/N-II launch vehicle 7F/Tanegashima Space Center
Orbit: elliptical orbit at an altitude of approx. 225 km to 36,000 km
Inclination: approx. 28.5 degrees
Period: approx. 636 minutes
Weight: approx. 640 kg

ETS-III Engineering Test Satellite III (Kiku-4)

● **Objectives:**
To verify engineering tests of the three-axis stabilized attitude control, deployment of solar array panels and active thermal control that are necessary for developing Earth-observation satellites.

● **Features:**
ETS-III completed functional testing of each item of equipment. It is loaded with deployable solar array panels, ion engine and video cameras.

Launch: September 3, 1982/N-I launch vehicle 9F/Tanegashima Space Center
Orbit: circular orbit at an altitude of approx. 1,000 km
Inclination: approx. 45 degrees
Period: approx. 107 minutes
Weight: approx. 385 kg

ETS-V Engineering Test Satellite V (Kiku-5)

● **Objectives:**
To establish the basic geostationary three-axis bus system technology, to develop original technology for advanced large-application satellites and to confirm the performance of the H-I launch vehicle.

● **Features:**
ETS-V carries an aeronautical maritime experimental transponder (AMEX) and deployable solar array panels. It was utilized for the Pan-Pacific Regional Telecommunications Network Experiments and Research by Satellite, PARTNERS Plan, from FY1992 to FY1995.

Launch: August 27, 1987/H-I launch vehicle No. 2 (H17F)/Tanegashima Space Center
Orbit: geostationary orbit at an altitude of approx. 36,000 km and 150 degrees East longitude
Weight: approx. 550 kg

ETS-VI Engineering Test Satellite VI (Kiku-6)

● **Objectives:**
To establish large-scale geostationary three-axis bus system technology, to test satellite communications equipment and to confirm the performance of the H-II launch vehicle.

● **Features:**
ETS-VI carries various equipment for bus system and communication system experiments. The injection into orbit was abandoned because of a malfunction in the apogee engine. Experiments were performed on the communication systems and bus systems on its elliptical orbit.

Launch: August 28, 1994/H-II launch vehicle 2F/Tanegashima Space Center
Orbit: elliptical orbit at an altitude of approx. 8,600 km to 38,600 km
Inclination: approx. 13 degrees
Period: approx. 14 hours 22 minutes
Weight: approx. 2,000 kg

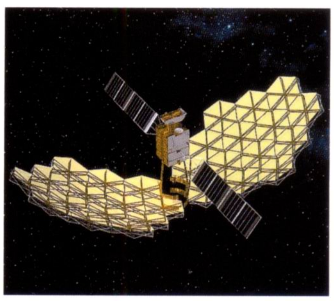
ETS-VII Engineering Test Satellite VII (Orihime/Hikoboshi)

● **Objectives:**
To carry out rendezvous and docking experiments, to acquire the basic technology for space robots and to develop operational technology for orbital operations via data relay satellites.

● **Features:**
Composed of a chaser satellite (Hikoboshi) and a target satellite (Orihime), ETS-VII carried out experiments on separation and docking in orbit. It was launched jointly with the Tropical Rainfall Measuring Mission (TRMM).

Launch: November 28, 1997/H-II launch vehicle 6F/Tanegashima Space Center
Orbit: circular orbit at an altitude of approx. 550 km
Inclination: approx. 35 degrees
Period: approx. 96 minutes
Weight: Chaser satellite: approx. 2,370 kg
Target satellite: approx. 430 kg

ETS-VIII Engineering Test Satellite VIII



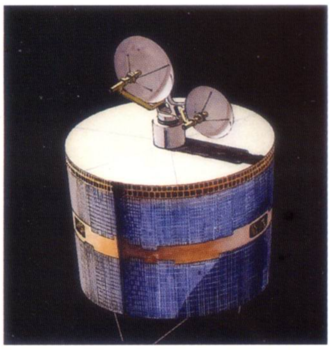
● **Objectives:**
To acquire bus technology for three-ton-class geostationary satellites, to acquire the basic technology for on-board large-scale deployable structures, to develop technologies for mobile satellite communication systems and mobile satellite digital multimedia broadcasting systems, and to acquire the basic technology for satellite positioning using the high-precision standard time system.

● **Features:**
To develop a large bus system that can meet the requirements of greater electrical power and increase in mission weight. To carry out experiments on communication systems that will enable mobile satellite communication using hand-held terminals, by using technologies for the large-scale deployable antenna and high-power transponder.

Orbit: geostationary orbit at an altitude of approx. 36,000 km
Weight: approx. 5 to 6 tons at the time of launching/approx. 2.5 to 3 tons at the beginning of mission life

Communications and Broadcasting Satellites

ECS Experimental Communications Satellites (Ayame)
ECS-b Experimental Communications Satellites (Ayame-2)



● Objectives:
To conduct communication experiments and research on radio wave propagation characteristics in the millimeter wave frequency band. To establish technologies related to geostationary satellites.

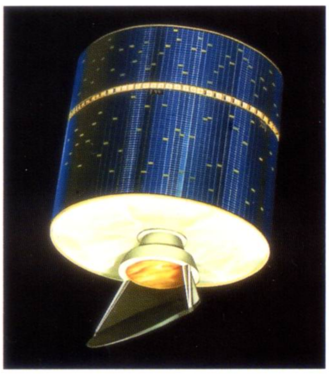
● Features:
The injection into orbit failed as the third-stage rocket came in contact with ECS, Ayame, after separation. Injection into orbit of ECS-b, Ayame-2, which was launched as the auxiliary satellite, failed due to a malfunction in the apogee engine.

Launch: ECS: February 6, 1979/N-I launch vehicle 5F/Tanegashima Space Center
ECS-b: February 22, 1980/N-I launch vehicle 6F/Tanegashima Space Center

Orbit: (Scheduled: geostationary orbit at an altitude of approx. 36,000 km and 145 degrees East longitude)

Weight: approx. 130 kg

CS Communication Satellite (Sakura)
CS-2a, -2b Communication Satellite (Sakura-2a, -2b)
CS-3a, -3b Communication Satellite (Sakura-3a, -3b)



● Objectives:
To conduct a variety of communications experiments to establish technologies for developing and operating application satellite communications systems. To develop technologies for advanced functions of communications satellites in the future.

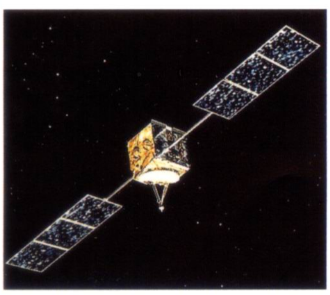
● Features:
After completing communications experiments, the CS communication satellites are providing various services. Sakura and Sakura-2 finished operations, and their communications services were handed over to Sakura-3.

Launch: CS: December 15, 1977/U.S. Delta 2914 launch vehicle/Kennedy Space Center
CS-2a: February 4, 1983/N-II launch vehicle 10F/Tanegashima Space Center
CS-2b: August 6, 1983/N-II launch vehicle 11F/Tanegashima Space Center
CS-3a: February 19, 1988/H-I launch vehicle No. 3 (H18F)/TanegashimaSpace Center
CS-3b: September 16, 1988/H-I launch vehicle No.4 (H19F)/Tanegashima Space Center

Orbit: geostationary orbit at an altitude of approx. 36,000 km for all the satellites CS: 135 degrees East longitude CS-2a: 132 degrees East longitude/CS-2b: 136 degrees East longitude CS-3a: 132 degrees East longitude/CS-3b: 136 degrees East longitude

Weight: CS: approx. 350 kg/CS-2a, -2b: approx. 350 kg/CS-3a, -3b: approx. 550 kg

BS Broadcasting Satellites (Yuri)
BS-2a, -2b Broadcasting Satellites (Yuri-2a, -2b)
BS-3a, -3b Broadcasting Satellites (Yuri-3a, -3b)



● Objectives:
To acquire technologies for developing and operating satellite broadcasting systems, and to eliminate areas with poor reception by using satellite broadcasting.

● Features:
Carrying broadcasting transponders, Yuri conducted broadcasting experiments. Yuri-2 started satellite broadcasting services and then Yuri-3 carried out test broadcasting for high-definition TV.

Launch: BS: April 8, 1978/U.S. Delta 2914 launch vehicle/Kennedy Space Center
BS-2a: January 23, 1984/N-II launch vehicle 12F/Tanegashima Space Center
BS-2b: February 12, 1986/N-II launch vehicle 14F/Tanegashima Space Center
BS-3a: August 28, 1990/H-I launch vehicle No. 7 (H22F)/Tanegashima Space Center
BS-3b: August 25, 1991/H-I launch vehicle No. 8 (H23F)/Tanegashima Space Center

Orbit: geostationary orbit at an altitude of approx. 36,000 km and 110 degrees East longitude for all the satellites

Weight: BS: approx. 250 kg/BS-2a, -2b: approx. 350 kg/BS-3a, -3b: approx. 550 kg

COMETS Communications and Broadcasting Engineering Test Satellites

● Objectives:
To carry out engineering experiments on inter-satellite communications technology for relaying communications between observation satellites in low-altitude circular orbit and earth stations via relay satellites in geostationary orbit. To carry out engineering experiments on advanced satellite broadcasting technology and advanced mobile satellite communications technology.

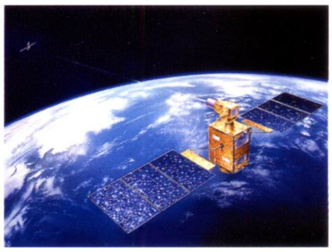
● Features:
COMETS was scheduled to carry out inter-satellite communications using relay satellites, broadcasting experiments such as regional broadcasting and high-definition TV, and experiments on mobile satellite communications, but injection into orbit was abandoned due to a malfunction in the second-stage engine of the H-II launch vehicle.

Launch: February 21, 1998/H-II launch vehicle 5F/Tanegashima Space Center

Orbit: geostationary orbit at an altitude of approx. 36,000 km and 121 degrees East longitude (estimated figures)

Weight: approx. 2,000 kg

OICETS Optical Inter-orbit Communications Engineering Test Satellite



● Objectives:
To conduct various experiments such as optical beam acquisition, tracking and directional control for achieving optical inter-orbit communications.

● Features:
OICETS will conduct experiments together with the ARTEMIS geostationary satellite of the European Space Agency (ESA). It will transmit and receive optical beams, while tracking and acquiring a satellite that is tens of thousands of kilometers away.

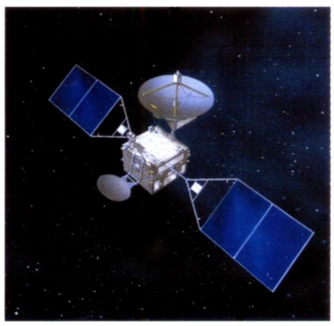
Orbit: circular orbit at an altitude of approx. 550-590 km

Inclination: approx. 35 degrees

Period: approx. 95 minutes

Weight: approx. 550 kg

DRTS-W, E Data Relay Test Satellite-West and East



● Objectives:
To enhance the data relay functions of inter-satellite communications, and to establish basic technology for the medium-size geostationary three-axis satellite bus system.

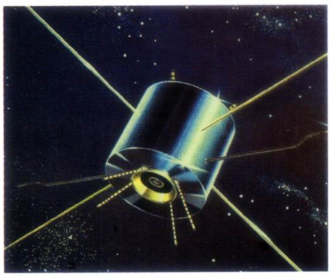
● Features:
In order to improve data relay speed and performance, two satellites (West and East), whose geostationary orbit positions are different in longitude, will be launched to carry out experiments on space communication networks. The satellites will carry deployable solar array paddles.

Orbit: geostationary orbit at an altitude of approx. 36,000 km
DRTS-W: 90 degrees East longitude (provisional)
DRTS-E: 170 degrees West longitude (provisional)

Weight: approx. 1,400 kg

Meteorological and Earth-Observation Satellites

ISS Ionosphere Sounding Satellites (Ume)
ISS-b Ionosphere Sounding Satellites (Ume-2)



● Objectives:
To monitor the ionosphere and to forecast conditions for optimal use of high-frequency communications.

● Features:
ISS has a cylindrical shape 94 cm in diameter and is Japan's first ionosphere satellite. Since a failure of the power supply system caused ISS to malfunction one month after launch, the auxiliary satellite ISS-b was subsequently launched.

Launch: ISS: February 29, 1976/N-I launch vehicle 2F/Tanegashima Space Center
ISS-b: February 16, 1978/N-I launch vehicle 4F/Tanegashima Space Center
Orbit: circular orbit at an altitude of approx. 1,000 km Inclination: approx. 70 degrees Period: approx. 105 minutes
Weight: ISS: approx. 139 kg ISS-b: approx. 141 kg

EGS Experimental Geodetic Satellite (Ajisai)

● Objectives:
To confirm the performance of the H-I launch vehicle, to correct Japan's domestic geodetic triangular net, to determine the exact position of many isolated Japanese islands (maintenance of the coastal ocean geodetic net), and also to establish Japan's geodetic point of origin.

● Features:
EGS is equipped with a sunlight reflecting mirror and laser reflection body. The survey was conducted by the Hydrography Department of the Maritime Safety Agency, the Ministry of Transport and the Geographical Survey Institute of the Ministry of Construction.

Launch: August 13, 1986/H-1 launch vehicle No. 1 (15F)/Tanegashima Space Center
Orbit: circular orbit at an altitude of approx. 1,500 km
Inclination: approx. 50 degrees
Period: approx. 116 minutes
Weight: ISS: approx. 685 kg

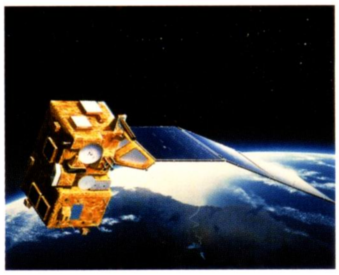
GMS Geostationary Meteorological Satellite (Himawari)
GMS-2 Geostationary Meteorological Satellite (Himawari-2)
GMS-3 Geostationary Meteorological Satellite (Himawari-3)
GMS-4 Geostationary Meteorological Satellite (Himawari-4)
GMS-5 Geostationary Meteorological Satellite (Himawari-5)

● Objectives:
To carry out meteorological observation from space and to function as part of the World Weather Watch Program sponsored by the World Meteorological Organization.

● Features:
Attitude control is conducted by the spin-stabilized method, with 100 revolutions per minute. The GMS has a Visible and Infrared Spin Scan Radiometer (VISSR), which obtains full-Earth disk imagery with 2,500 scans at 30-minute intervals.

Launch: GMS: July 14, 1977/U.S. Delta 2914 launch vehicle/Kennedy Space Center
GMS-2: August 11, 1981/N-II launch vehicle 8F/Tanegashima Space Center
GMS-3: August 3, 1984/N-II launch vehicle 13F/Tanegashima Space Center
GMS-4: September 6, 1989/H-I launch vehicle No. 5 (H20F)/Tanegashima Space Center
GMS-5: March 18, 1995/H-II launch vehicle 3F/Tanegashima Space Center
Orbit: geostationary orbit at an altitude of approx. 36,000 km and 140 degrees East longitude
Weight: GMS: approx. 325 kg/GMS-2: approx. 296 kg GMS-3: approx. 303 kg/GMS-4: approx. 325 kg GMS-5: approx. 345 kg

MOS-1 Marine Observation Satellite (Momo-1)
MOS-1b Marine Observation Satellite (Momo-1b)



● Objectives:
To effectively utilize the natural resources of the Earth, to observe marine phenomena for environmental protection and to establish common technology for Earth-observation satellites.

● Features:
MOS-1 is Japan's first Earth-observation satellite. It carries three observation sensors that have different characteristics and performance. It is also equipped with a single-wing deployable solar array paddle.

Launch: MOS-1: February 19, 1987/N-II launch vehicle 16F/Tanegashima Space Center
MOS-1b: February 7, 1990/H-I launch vehicle No. 6 (H21F)/Tanegashima Space Center
Orbit: sun-synchronous subrecurrent orbit at an altitude of approx. 909 km
Inclination: approx. 99 degrees
Period: approx. 103 minutes
Weight: approx. 740 kg

JERS-1 Japanese Earth Resources Satellite (Fuyo-1)

● Objectives:
To gather data on global land masses for survey and monitoring of natural resources; national land survey; the environment; agriculture, forestry and fisheries; and disaster prevention.

● Features:
JERS-1 is equipped with a synthetic aperture radar and optical sensor. JERS-1 is a joint project among NASDA, the Science and Technology Agency and MITI. NASDA and the Science and Technology Agency were responsible for developing the main satellite unit, while MITI developed the measuring instruments. JERS-1 is equipped with a deployable solar array paddle and antenna.

Launch: February 11, 1992/H-I launch vehicle No. 9 (H24F)/Tanegashima Space Center
Orbit: sun-synchronous subrecurrent orbit at an altitude of approx. 570 km
Inclination: approx. 98 degrees
Period: approx. 96 minutes
Weight: approx. 1,400 kg

ADEOS Advanced Earth Observing Satellite (Midori)

● Objectives:
To conduct global-scale observation of environmental changes such as global warming, ozone destruction, decrease in tropical rain forest, and to develop technologies for a next-generation Earth-observation platform.

● Features:
ADEOS carries the Advanced Visible Near Infrared Radiometer (AVNIR) and Ocean Color and Temperature Scanner (OCTS), which were both developed by NASDA. There are also six kinds of Announcement of Opportunity (AO) sensors developed by the Environmental Agency, MITI, NASA (U.S.) and CNES (France). On June 30, 1997, operation of ADEOS was abandoned due to damage to its solar array paddle.

Launch: August 17, 1996/H-II launch vehicle 4F/Tanegashima Space Center
Orbit: sun-synchronous subrecurrent orbit at an altitude of approx. 800 km
Inclination: approx. 98.6 degrees
Period: approx. 101 minutes
Weight: approx. 3,500 kg

Other Satellites

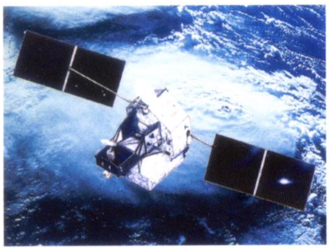
ADEOS-II Advanced Earth Observing Satellite II

● **Objectives:**
To continue and improve the broad-ranging observation technology created by ADEOS, and to conduct global monitoring of environmental changes such as in the circulation of water and energy.

● **Features:**
ADEOS-II is equipped with an Advanced Microwave Scanning Radiometer (AMSR) and Global Imager (GLI), both developed by NASDA, as well as various sensors developed by the Environmental Agency, NASA (U.S.) and CNES (France).

Orbit: sun-synchronous subrecurrent orbit at an altitude of approx. 800 km
Inclination: approx. 98.6 degrees
Period: approx. 101 minutes
Weight: approx. 3,500 kg

TRMM Tropical Rainfall Measuring Mission



● **Objectives:**
To measure rainfall and its distribution in tropical regions, and to utilize the observation data for forecasting global climatic changes.

● **Features:**
TRMM is a joint project between Japan and the U.S. Japan provided a launcher for TRMM and developed the Precipitation Radar, while the U.S. was responsible for developing four kinds of sensor (excluding the Precipitation Radar), and was in charge of developing the satellite bus. The U.S. was also responsible for operations of the satellite. TRMM has solar array paddles on both wings.

Launch: November 28, 1997/H-II launch vehicle 6F/Tanegashima Space Center
Orbit: circular (non sun-synchronous) orbit at an altitude of approx. 350 km
Inclination: approx. 35 degrees
Weight: approx. 3,620 kg

ALOS Advanced Land Observing Satellite

● **Objectives:**
To provide cartography for Japan and other countries, such as those in the Asia-Pacific region. To perform land observations with high resolution for disaster monitoring, disaster prevention and environmental protection.

● **Features:**
ALOS is equipped with three different kinds of observation sensors: two kinds of optical sensor, PRISM and AVNIR-2, and the Phased Array type L-band Synthetic Aperture Radar (PALSAR). It is thus possible to conduct more flexible observation with higher resolution than in the past.

Orbit: sun-synchronous subrecurrent orbit at an altitude of approx. 700 km
Inclination: approx. 98 degrees
Period: approx. 99 minutes
Weight: approx. 3,850 kg

MDS-1 Mission Demonstration Satellite-1

● **Objectives:**
To verify the functions of commercial components and devices in orbit, to verify technology for minimizing components and to measure space environment data such as radiation.

● **Features:**
MDS-1 carries equipment for acquiring space environment data in the short term regarding the radiation resistance of components, in order to carry out correlative evaluation between the space environment and the components' characteristics.

Orbit: elliptical orbit at an altitude of between approx. 225 km and 36,000 km
Weight: to be decided

MDS-2 Mission Demonstration Satellite-2

● **Objectives:**
To measure the vertical distribution of clouds in the atmosphere and atmospheric trace molecules, using lidar (laser radar) to clarify factors behind global warming and climatic changes, and to gather basic observation data.

● **Features:**
MDS-2 carries the world's first lidar installed in a satellite.

Orbit: circular orbit at an altitude of approx. 550 km (provisional)
Inclination: approx. 30 degrees
Period: 95 minutes
Weight: undecided

SELENE Selenological and Engineering Explorer

● **Objectives:**
In addition to the observation results obtained so far by the U.S. and Russia, to conduct overall research on the surface structure and composition of the moon, to measure the gravity fields of the moon and also to demonstrate lunar-landing technology.

● **Features:**
SELENE is a joint project between the Institute of Space and Astronautical Science (ISAS) and NASDA.

Orbit: circular orbit at an altitude of approx. 100 km from the moon
Inclination: approx. 95 degrees
Period: 118 minutes
Weight: approx. 2,800 kg

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